Time-Lapse Imaging Methods in Synthetic Aperture Radar

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Synthetic aperture radar processing and interpretive analysis use time-lapse methods at essentially all time scales. At the millisecond scale, aperture synthesis itself and variants to account for objects in motion involve time-lapse imaging concepts. At the scale of hours to growing seasons, SAR images are used in time series to monitor environmental surface changes in soil moisture, biomass or flood extent. At the widest possible scale – from minutes to decades – repeated SAR observations of the surface can image crustal deformation such as earthquake ruptures or aseismic slip. SAR observables of backscatter, phase, differential (interferometric) phase, and polarization are all subject to time-lapse analysis. Time-lapse methods in SAR can be benign, for example coregistration, visualization and analysis of time-series of radar backscatter. More complex methods include combinatorial selection of appropriate complex imagery for interferometric analysis and robust feature tracking algorithms in SAR data. Data requirements range from processing a single scene at fine resolution over a variety of subapertures to track object motion to global low resolution imagery available on a daily basis tracking soil moisture changes. In this talk, I will survey the field, offering a summary of the latest methods for SAR and my view of future directions.